REMARKS

A Substitute Specification and Abstract is submitted herewith to place the case in better English form. The Substitute Specification and Abstract contains no new matter. In order that the examiner can satisfy himself in this regard, also submitted herewith is a marked-up copy of the original Specification and Abstract from which the Substitute Specification and Abstract was typed.

Respectfully submitted,

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AUTOMATIC TRANSMISSION

Claim 12/8

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CROSS-REFERENCE TO RELATED APPLICATION

~~DESCRIPTION~~

The present application is a United States of America National Phase, filed under 35 USC 371, of International Application No. , filed , and claims priority of Japanese Application No. , filed

~~AUTOMATIC TRANSMISSION~~

BACKGROUND OF THE INVENTION

Technical Field

The present invention relates to an automatic transmission ~~mounted on~~ for a vehicle ~~and so forth~~, and more specifically, it relates to ~~the construction configuration of~~ an automatic transmission wherein multiple speeds ~~levels~~ are ~~made possible by enabling inputting~~ enabled by input of reduced speed rotation into one of the rotation components of a planetary gear unit.

Background Art

~~Generally, there is known an~~ One Type of conventional automatic transmission incorporated ~~in a~~ into vehicles or the like ~~which~~ comprises a first planetary gear unit with two rows of linked planetary gears, including a second planetary gear unit which reduces and ~~that can output reduced rotation wherein~~ the rotation speed of the input shaft ~~is reduced~~ (for example, see Japanese Unexamined Patent Application Publication No. 4-125345). The transmission disclosed in this publication provides ~~This achieves~~, for example, six forward speeds and one reverse speed, by ~~enabling~~ input of reduced speed rotation from the planetary gear via a clutch to a second unit, for example, one of four rotation components of the first planetary gear unit, ~~that has four rotation components.~~ Further, in the case of fourth speed forward, for example, when the rotation of the

input shaft is input ~~together~~ into two of the rotary components of the first planetary gear unit, this fourth speed forward can be become a directly coupled state, with the output at ~~rotations~~ the same rotational speed as the input shaft.

The above-described automatic transmission comprises two clutches for inputting the rotation of the input shaft into two of the rotary components of the first planetary gear unit, and a second planetary gear unit for outputting the reduced rotation into the rotary components of the first planetary gear unit. However, if those two clutches or the hydrulic servos that control their engagement are positioned between the first and second planetary gear unit, the element for transmitting the reduced speed rotation of the second planetary gear unit to a rotary components of the first planetary gear unit must be axially elongated.

The speed that transmits the reduced rotation that rotation with high torque must also be elongated. Further, if an elongated element must withstand the large torque, it must be fabricated of a relatively thick material which making more compact automatic transmission. Further, because the weight of such a member would be increased, is the objective of not only a lightweight automatic transmission defeated also, but inertia (force of inertia) would increase, reducing the controllability of the

automatic transmission and shock ~~of~~ speed change ~~would result more easily.~~

Further, for example, in order to ~~engage or disengage~~ the reduced rotation output to the planetary gear unit from the planetary gear, a clutch or brake must be provided. In the case that a clutch is provided, this clutch and the above-described two clutches, ~~in other words~~ three clutches, are necessary. ~~In general,~~ a clutch ~~has a drum shaped member (~~clutch drum~~)~~ that transmits the input rotation to ~~the~~ friction plates, and therefore, for example with a problem such as relative rotation, ~~supplying~~ oil pressure to the oil compartment of the ~~oil pressure~~ servo of the clutch must be supplied from the mid-section of the automatic transmission.

However, if ~~those~~ three clutches are ~~configured~~ on one side ~~in the direction of the axis~~ of the planetary gear unit, for example, oil lines for supplying oil pressure to three ~~oil pressure~~ servos ~~are constructed~~ in triplicate in the mid-section of the automatic transmission ~~for example~~, and the configuration of the oil lines become complicated.

SUMMARY OF THE INVENTION

Accordingly, the object of the present invention is to ~~solve the above problems by~~ provide an automatic transmission with a first clutch that is located between ~~the~~ planetary gear and input shaft ~~and the input rotation components~~, and a brake ~~that is capable of~~ fixing ~~the~~ rotation ~~fixing~~ components, on one side of ~~the~~

planetary gear unit ~~in the axial direction~~, and with a second clutch and a third clutch on the other axial side of the second planetary gear unit, ~~in the axial direction, and hence solve the problems mentioned above~~.

~~Disclosure of Invention~~

Accordingly, the present invention provides ~~according to Claim 1 is~~ an automatic transmission comprising: an input shaft that ~~rotates based on~~ transmits the output rotation of a drive source; a ~~reducing~~ decelerating first planetary gear unit comprising an input ~~rotation~~ rotary component ~~that can input~~ which receives the rotation of the input shaft, an ~~rotation fixing component that fixes the rotation~~ intermediate component, a ~~reduced~~ decelerated ~~rotation~~ rotary component that ~~can reduce~~ rotation speed is reduced based on ~~the rotation of~~ rotation received from the input ~~rotation~~ rotary component ~~and~~ through the ~~rotation fixing~~ intermediate component; engaging means for ~~operating~~ controlling the rotation of the input ~~rotation~~ rotary component or ~~the~~ rotation of the ~~rotation fixing~~ intermediate component; a second planetary gear unit comprising ~~a~~ first, ~~rotation component and a~~ second, ~~rotation component and a~~ third and ~~rotation component and a~~ fourth ~~rotation component~~ rotary elements for ~~inputting~~ receiving the ~~reduced~~ decelerated rotation transmitted from ~~of~~ the ~~reduced~~ decelerated rotation component; a first clutch for ~~linking~~ selectively connecting the input shaft and the second ~~rotation component so as to be capable of disengaging~~ rotary element; a second clutch for ~~linking~~ selectively connecting the input shaft and the third ~~rotation component so as to be capable of disengaging~~ rotary element; and an output member for outputting

the rotation of the fourth ~~rotation component~~ rotary element to a wheel ~~wheel transmitting device~~ mechanism, ~~wherein~~ The automatic transmission of the present invention provides at least five forward speeds and one reverse speed, ~~can be achieved,~~ and the first clutch and the second clutch ~~can be~~ are engaged together ~~while~~ in ~~at~~ fourth speed forward, ~~and wherein~~ the first planetary gear unit and the engaging means are ~~configured~~ located on one axial side ~~in the axial direction~~ of the second planetary gear unit, ~~and wherein~~ while the first ~~clutch~~ and ~~the~~ second clutch are ~~configured~~ located on the other axial side ~~in the axial direction~~ of the second planetary gear unit, and ~~wherein~~ the output member is ~~disposed~~ located between the (1) second planetary gear unit and (2) decelerating first ~~reducing~~ planetary gear unit and the engaging means.

Accordingly, ~~an~~ the automatic transmission of the present invention ~~can be~~ provides ~~that will achieve~~ at least five forward speeds and one reverse speed with direct coupling ~~at~~ in fourth speed forward, ~~while for example~~, and compared to the case wherein two clutches are ~~configured~~ located between the ~~planetary gear and the~~ first and second planetary gear unit, the ~~planetary gear and the~~ planetary gear units can be ~~configured~~ located close together, and the transmitting member for transmitting the ~~reduced~~ decelerated rotation can be made relatively short. Therefore, the automatic transmission can be made more compact and lightweight, and further, because the inertia (~~force of~~ inertia) can be reduced, the controllability of the automatic transmission ~~can be~~ is improved, and the occurrence of speed change shock ~~can be~~ is

reduced.

Further, due to the output unit being ~~configured in the~~ located axial ~~direction~~ between the second planetary gear unit and the first (reducing) planetary gear unit and the engaging means, the output unit can be ~~configured~~ located in approximately the axial center ~~in the axial direction~~ of the automatic transmission. ~~For example~~, Thus, when the automatic transmission is mounted on ~~the~~ a vehicle, there is no need for enlargement in ~~increase in size towards~~ axial one direction ~~of the axis (particularly the rear direction when the input side from the drive source is the front direction) can be prevented~~ because the output unit is mounted ~~to match~~ adjacent the drive wheel transmission mechanism. Because of this, particularly in the case of ~~an~~ a FF vehicle, ~~the~~ interference with toward the front wheels is reduced, and the mountability on ~~a~~ the vehicle can be improved, ~~such~~ e.g. the steering angle ~~being~~ is greatly improved, ~~for example~~.

The present invention according to Claim 2 is ~~configured such that the engaging means~~ is a first brake capable of fixing the rotation fixing component.

~~The present invention according to Claim 3 is configured such that~~ The engaging means may be a first clutch located between the input shaft and the input ~~rotation~~ rotary component, and a first brake ~~capable of fixing~~ for braking the ~~rotation fixing component~~ intermediate component. The first clutch is designed to engage at relatively slow to medium speeds.

~~Further, three clutches will be configured, but~~

compared to the case wherein three clutches are configured on one side of the planetary gear unit, the construction of an oil line to provide oil to the oil pressure servos for these clutches can be made easily, and the manufacturing process can be simplified and the costs brought down. Further, since the friction member and oil pressure servo of the third clutch can be made smaller, it can be configured on the inner circumference side in the radial direction of the second brake, and the automatic transmission can be made more compact.

The present invention according to claim 4 is configured wherein the engaging means is a third clutch located between the input shaft and the input rotation component.

Further, three clutches will be configured, but compared to the case wherein three clutches are configured on one side of the planetary gear unit, the construction of an oil line to provide oil to the oil pressure servos for these clutches can be made easily, and the manufacturing process can be simplified, and the costs brought down. Further, since the friction member and oil pressure servo of the third clutch can be made smaller, it can be configured on the inner circumference side in the radial direction of the second brake, and the automatic transmission can be made more compact.

In one embodiment, the present invention ~~according to Claim 5 comprises~~ also includes a second brake ~~capable of~~ for fixing the first ~~rotation component~~ rotary element which receives input as ~~wherein~~ the ~~reduced~~ decelerated rotation is input. ~~wherein the~~ The second brake and the third clutch each ~~comprise a~~ include friction members and ~~an oil pressure~~ a hydraulic servo for ~~pressing~~ engaging the friction members, ~~and wherein~~ the friction members of the third clutch ~~is~~ are located ~~disposed on the inner circumference side in the~~ radially outward ~~direction~~ of the friction members of the second brake.

No ¶ → Accordingly, the third clutch is between the input shaft and input ~~rotation~~ rotary component, whereby the load on the third clutch can be reduced as compared to arrangements wherein, for example, the third clutch is between the input ~~rotation~~ rotary component and first ~~rotation component~~ rotary element. ~~and~~ Therefore, the third clutch can be made more compact, so the friction members of the third clutch and ~~the oil servo thereof~~ its hydraulic servo can be reduced ~~and~~ in size, allowing ~~placement~~ location on the radially inner ~~circumference~~ side ~~in the radial direction~~ of the second brake, thereby enabling ~~making~~ the automatic transmission to be made more compact.

~~With the present invention according to Claim 6,~~ The third clutch ~~is configured~~ may be located between the first (reducing) planetary gear unit and the output member ~~wherein~~ with the drum member of the third clutch ~~is configured so as to~~ opening toward the ~~reducing~~ first planetary gear unit.

The present invention ~~according to Claim 7 is~~ may also include

~~configured comprising~~ a linking unit (or "member") for linking the ~~decelerated~~ rotary ~~reduced rotation~~ component and the first ~~rotation component, wherein~~ rotary element, with the third clutch ~~is configured~~ located radially on the inner ~~circumference~~ side of the linking unit.

~~With the present invention according to Claim 8,~~ the ~~oil pressure~~ hydraulic servo of the third clutch is preferably located ~~configured~~ on the input shaft, ~~so as to~~ in communicate with an oil path ~~provided~~ extending ~~to~~ From the case ~~via~~ through an oil path provided ~~to~~ in the input shaft.

~~With the present invention according to Claim 9,~~ the third clutch ~~comprises a~~ includes friction member and ~~an oil pressure~~ a hydraulic servo for ~~pressurizing this~~ engaging the friction member, wherein the ~~oil~~ hydraulic ~~pressure~~ servo is ~~configured~~ axially located on the ~~opposite~~ side of the friction members opposite the first ~~reducing~~ planetary gear unit ~~in the axial direction as to the friction member~~, and ~~wherein a drum member constructing a~~ decelerating cylinder of this ~~oil pressure~~ hydraulic servo is linked ~~with~~ to the input shaft.

~~The present invention according to Claim 10 is configured with~~ the first brake may be axially located ~~configured~~ on the ~~opposite~~ same side ~~in the axial direction~~ of the second planetary gear unit as ~~of~~ the ~~reducing~~ First planetary gear unit, ~~wherein the oil pressure~~ with its hydraulic servo ~~of the first brake is provided to~~ formed in the case.

The present invention ~~according to Claim 11 is configured comprising~~ preferably also includes a second brake ~~capable of~~ for fixing the first ~~rotation component wherein~~ rotary element which receives input of the reduced rotation speed ~~is input, wherein~~ In such embodiments the first brake and the second brake each

~~comprise a~~ include friction members and ~~an oil pressure~~ a hydraulic servo for ~~pressing~~ engaging the friction members, ~~and wherein~~ the ~~oil pressure~~ hydraulic servo of the first brake ~~is configured~~ may be located on the ~~inner circumference~~ radially inward side ~~in the radial direction~~ of the ~~oil pressure~~ hydraulic servo of the second brake, and the friction members of the first brake mesh~~ing~~ with a member extended ~~from~~ between the ~~oil pressure~~ hydraulic servo of the first brake and the ~~oil pressure~~ hydraulic servo of the second brake.

~~The present invention according to Claim 12 is configured comprising~~ In embodiments wherein a second brake ~~capable of fixing~~ is provided to fix the first ~~rotation component wherein the reduced rotation is input, wherein~~ rotary element against rotation, the engaging means ~~is configured in a location so as to wrap in the radial direction on the inner circumference side~~ may be located radially inward of the second brake.

~~The present invention according to Claim 13 is configured such that the first clutch is a clutch that engages at a relatively slow to medium speed level.~~

~~Accordingly,~~ When ~~this~~ the first clutch is released at a relatively high speed ~~level~~ or ~~at the~~ in the reverse ~~speed level~~, ~~particularly~~ with the unit connecting this first clutch and second ~~rotation component result in~~ rotary element rotating at the relatively high ~~rotation~~ speed or reverse ~~rotation~~ speed, ~~while~~ there may be cases wherein the transmitting member that transmits the ~~reduced~~ decelerated rotation from the first planetary gear ~~reduces rotation~~ unit is rotating at a reduced speed or is fixed, and ~~some cases may occur wherein the revolution~~ there is a large difference in rotational speed between the first clutch and the transmitting member.

~~difference thereof may be large.~~ However, because ~~this~~ the first clutch is axially located on the ~~opposite~~ side of the second unit opposite first planetary gear ~~via~~ the planetary gear unit, that is to say, the unit with a relatively high speed rotation or ~~a~~ reverse rotation and ~~a~~ the unit with ~~a reduced~~ decelerated rotation (particularly the linking member) can be ~~configured~~ spaced apart, and compared with the case wherein for example those units are ~~configured~~ in contact ~~with~~ in a multi-axial ~~construction~~ arrangement, ~~the~~ a decreased in efficiency of the automatic transmission resulting from the relative ~~rotation~~ speed difference between ~~the~~ members can be prevented.

~~With the present invention according to Claim 14, the~~ The first clutch ~~comprises a~~ includes friction members, ~~an oil pressure~~ a hydraulic servo that ~~pressurizes this~~ engages friction members, ~~a drum unit that is constructed integrally with the oil pressure servo,~~ and a hub, ~~unit, and the drum unit is~~ with cylinder of the hydraulic servo linked with the input shaft, ~~and the hub unit~~ which is linked with the second ~~rotation~~ rotary element component.

~~The present invention according to Claim 15 is~~ Preferably, ~~configured such that~~ the linking member that links the reduced ~~rotation~~ speed rotary component of the first planetary gear unit with ~~and~~ the first ~~rotation component~~ rotary element of the second planetary gear unit, ~~are~~ (the output member, i.e. radially inward of the ~~mutually linked~~ pass~~ing~~ through the inner circumference of the output member.

The present invention ~~according to Claim 16~~ preferably further ~~comprises~~ includes a differential unit for outputting rotations to

driving wheels, and a counter shaft unit for engaging the differential unit, wherein the output member is a counter gear meshing with the counter shaft unit.

The present invention according to Claim 17 is configured such that wherein, in a speed line chart illustrating the revolutions of the first, second, third, and fourth rotation components with the vertical axis, and the gear ratio of the first, second, third, and fourth rotation components with the horizontal axis in a corresponding manner; the first rotation component to which the reduced rotation is input is positioned at the farthest edge in the horizontal direction, with the third rotation component, the fourth rotation component linked to the output member, and the second rotation component, corresponding in that order.

The present invention according to Claim 18 is configured such that the planetary gear unit is a multiple type planetary gear, comprising a first sun gear, a long pinion which meshes with the first sun gear, a short pinion which meshes with the long pinion, a carrier for rotationally supporting the long pinion and the short pinion, a second sun gear meshing with the short pinion, and a ring gear meshing with the long pinion, wherein the first rotation component is the first sun gear capable of inputting the reduced rotation of the reduced rotation.

~~output means~~, and ~~which is capable of being~~ is fixed by the ~~retaining of the~~ second brake; ~~and wherein~~ the second ~~rotation component~~ rotary element is the second sun gear ~~capable of~~ for receiving inputting rotation of the input shaft by ~~the~~ engaging ement of the first clutch; and ~~wherein~~ the third ~~rotation component~~ rotary element is ~~the~~ a carrier capable of inputting receiving the rotation of the input shaft by ~~the~~ engaging ement of the second clutch, and which is ~~capable of being~~ fixed by ~~the retaining~~ engagement of a third brake; and wherein the fourth ~~rotation component~~ rotary element is the ring gear linked to the output member.

~~The present invention according to claim 19 is~~ In operation, preferably ~~configured wherein~~, in ~~the~~ first speed forward, the first clutch ~~is engaged~~ and the third brake ~~is retained~~ are engaged; ~~and wherein,~~ in ~~the~~ second speed forward, the first clutch ~~is engaged~~ and the second brake ~~is retained~~ are engaged; ~~and wherein~~, in ~~the~~ third speed forward, ~~reduced~~ decelerated rotation is input to the first ~~rotation component~~ rotary element from the ~~reduced rotation output means~~ decelerated rotary component, and the first clutch is engaged; ~~and wherein,~~ in ~~the~~ fourth speed forward, the first clutch and the second clutch are both engaged; ~~and wherein,~~ in ~~the~~ fifth speed forward, ~~reduced~~ decelerated rotation is input to the first ~~rotation component~~ rotary element from the ~~reduced rotation output~~ decelerated rotary component means, and the second clutch is engaged; and ~~wherein,~~ in ~~the~~ sixth speed forward, the second clutch ~~is engaged~~ and the second brake ~~is~~ are engaged ~~retained~~; and ~~wherein~~, in ~~the~~ first speed reverse, reduced speed

rotation is input to the first ~~rotation component~~ rotary element from the ~~reduced rotation output means~~ decelerated rotary component, and the third brake is ~~retained~~ engaged; whereby six forward speed ~~levels~~ and one reverse speed ~~level~~ can be achieved.

Brief Description of the Drawings

Fig. 1 is a schematic cross-sectional ~~diagram illustrating an automatic transmission device~~ view of an automatic transmission ~~relating to the~~ according to the present invention of a first embodiment; Fig. 2 is a ~~operational~~ table of ~~an~~ the automatic transmission ~~relating to~~ of the first embodiment, Fig. 3 is a speed line diagram of ~~an~~ the automatic transmission ~~relating to~~ of the first embodiment, Fig. 4 is a schematic cross-sectional ~~diagram illustrating~~ view of an automatic transmission ~~device of an automatic transmission relating~~ according to a second embodiment; Fig. 5 is a schematic cross-sectional ~~diagram illustrating~~ of a third embodiment according to the present invention of an automatic transmission ~~device of an automatic transmission relating to the third embodiment;~~ Fig. 6 is a ~~operational~~ table of operations of ~~an automatic transmission relating to~~ the third embodiment, Fig. 7 is a speed line diagram ~~of an~~ for the automatic transmission ~~relating to~~ of the third embodiment, Fig. 8 is a schematic cross-sectional ~~diagram illustrating~~ of a fourth embodiment of an automatic transmission ~~device of an automatic transmission relating to the fourth embodiment~~ according to the present invention; Fig. 9 is a ~~operational~~ table of operations of ~~an~~ the automatic transmission ~~relating~~ according to the fourth

embodiment, and Fig. 10 is a speed line diagram of an automatic transmission ~~relating~~ according to the fourth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

~~Best Mode for Carrying Out the Invention~~

~~First Embodiment~~

~~The~~ A first embodiment ~~relating to~~ of the present invention will be described ~~following~~ with reference to Fig. 1 through Fig. 3 below.

~~Fig. 1 is a schematic cross sectional diagram illustrating~~ the automatic transmission device of an automatic transmission relating to the first embodiment, Fig. 2 is a operational table of an automatic transmission relating to the first embodiment, and Fig. 3 is a speed line diagram of ~~an automatic transmission relating to the first embodiment.~~

~~An~~ This automatic transmission ~~relating to~~ of the first embodiment ~~according to~~ of the present invention ~~has an automatic transmission device 1~~ as illustrated in Fig. 1. ~~This~~ is particularly favorable for an FF (front engine, front wheel drive) vehicle, and has a ~~case comprising a~~ torque converter housing ~~case~~, not illustrated, and a transmission case 3. ~~and~~ Within the torque converter ~~this~~ housing ~~case~~ is ~~configured~~ a torque converter, not illustrated, ~~within this~~ The transmission case 3 ~~is configured~~ houses an automatic transmission ~~device~~ 1_1, a counter shaft unit (drive wheel transmission mechanism), not illustrated, and a differential unit (drive wheel transmission mechanism).

The arranged with its
~~This~~ torque converter is ~~configured~~, for example, ~~on~~ ~~the~~ axis ~~that is~~ centered on ~~an~~ input shaft 2 of the automatic transmission ~~device~~ 1_1, which is on the same axis as the output shaft of the engine (not illustrated), and the also centered axis of the engine
~~this~~ automatic transmission ~~device~~ 1_1 is ~~configured~~ on the output shaft ~~of this engine, in other words, the axis that is centered on the input shaft 2. Further~~, the above-mentioned counter shaft unit includes ~~is configured on~~ a counter shaft (not illustrated) with its ~~on an~~ axis arranged ~~that is~~ parallel to the input shaft 2, and the above-mentioned differential unit ~~is configured so as to~~ has a lateral axle, not illustrated, ~~on~~ arranged with its ~~an~~ axis ~~that is~~ parallel to that of the ~~this~~ counter shaft.

The
~~Next, the~~ automatic transmission ~~device~~ 1_1 of the ~~automatic transmission relating to the~~ first embodiment will now be described with reference to Fig. 1. As illustrated in Fig. 1, the automatic transmission ~~device~~ 1_1 comprises a front (second) planetary gear unit PU and a rear (first) planetary gear unit PR on the input shaft 2. The front ~~This~~ planetary gear unit PU is a multiple-type planetary gear unit, which has a sun gear S2 (the second rotary element ~~component~~), a carrier CR2 (the third rotary element ~~rotation component~~), a ring gear R3 (the fourth rotary element ~~rotation component~~), and a sun gear S3 (the first rotary elements ~~rotation component~~), as the four rotary elements ~~components, wherein~~ the carrier CR2 has a long pinion PL that meshes with a sun gear S3 and a ring gear R3, and a short pinions PL and PS ~~which~~ are

meshed ~~to~~ with one another. ~~Further, the above mentioned~~ The rear planetary gear unit PR is a double planetary gear unit ~~that has a~~ which includes carrier (~~rotation fixing~~ intermediate component) CR1, ~~wherein~~ a pinion Pb which meshes with a ring gear (reduced ~~rotation~~ speed rotary component) R1 and a pinion Pa which meshes with a sun gear (input rotation component) S1, ~~which~~ Pinions Pa and Pb are meshed one to another.

~~On the above mentioned input shaft 2 is configured a~~ ~~oil pressure~~ A hydraulic servo 13, a friction plates 73, ~~a drum-shaped member 25 that forms~~ a clutch drum, and a multi-disc clutch C3 (the third clutch) ~~that comprises~~ which includes a hub unit 26, are arranged centered on the input shaft 2. ~~This oil pressure~~ The hydraulic servo 13 ~~is constructed from~~ includes a piston unit b for ~~pressurizing~~ engaging the friction plates 73, a drum-shaped member 25 that has a cylinder unit e, an oil chamber "a" which is formed ~~by~~ as a space sealed by seal rings f and g between ~~this~~ the piston unit b and ~~this~~ the cylinder unit e ~~with seal rings f and~~ g, a return spring c that ~~energizes this~~ biases piston unit b toward ~~this~~ the oil chamber "a", and a return plate d that ~~absorbs~~ bears the ~~energy~~ force of ~~this~~ the return spring c.

~~Now, for the following descriptions, each oil pressure~~ The other hydraulic servos ~~shall be considered as being~~ are constructed similarly ~~from~~ having an oil chamber "a", ~~the~~ a piston unit b, ~~the~~ return spring c, ~~the~~ return plate d, ~~the~~ cylinder unit e, and ~~the~~ seal rings f and g, and ~~as such~~ therefore, description thereof will be omitted.

The oil chamber "a" of ~~this oil pressure~~ hydraulic servo 13 is

connected to an oil line 2a which is formed ~~on~~ in the input shaft 2, and this oil line 2a is ~~provided along one edge of the case 3, and is~~ connected to an oil line 92 ~~of~~ at a boss ~~unit~~ of case 3 forms a sleeve around 3a which ~~is formed on this~~ input shaft 2 ~~in sleeve form~~. ~~Further, this~~ Oil line 92 ~~is~~ connected to an oil pressure control unit, not illustrated. ~~In other words~~, Thus because the ~~above-mentioned oil~~ hydraulic pressure servo 13 is ~~configured~~ arranged on input shaft 2, an oil ~~line~~ path from the oil pressure control unit, ~~not illustrated,~~ to the oil chamber "a" of the oil pressure servo 13 is constructed simply by providing one set of seal rings 81 ~~to seal~~ between ~~this~~ boss ~~unit~~ 3a and the input shaft 2.

~~Further,~~ The ~~above-mentioned~~ input shaft 2 is connected to the ~~above-mentioned~~ drum ~~-shaped member~~ 25, ~~and on the front edge of the~~ having an inner circumferential surface ~~side of this drum-shaped member 25 is configured~~ to which the friction plates 73 of the clutch C3 ~~which is capable of engaging by the oil pressure servo~~ are 13 ~~for the clutch C3, by being~~ splined, ~~and is connected with the~~ inner ~~circumference~~ side ~~of~~ the friction plates 73 of ~~this~~ clutch C3 are intermeshed with friction plates splined to the hub ~~unit~~ 26, which ~~Further, this hub unit 26~~ is connected to the ~~above-mentioned~~ sun gear S1. ~~Further, the~~ Carrier CR1 ~~has~~ supports the pinion Pa ~~and the pinion~~ Pb, ~~and this~~ pinion Pb meshes with the ~~above-mentioned ring~~ gear R1, and ~~this~~ pinion Pa meshes with the sun gear S1 which is connected to the input shaft 2.

The carrier CR1 is secured to the boss ~~unit~~ 3a of the case 3 for free rotation via a side plate, and the ring gear R1 is supported by ~~a supporting unit 31 to~~ through member 31 the boss ~~unit~~ 3a ~~so as to freely rotate.~~

On the outer circumference ~~ee~~ tial side of this ring gear R1 is ~~configured~~ includes a hydraulic a multi-disc brake B1 (the second brake) that ~~comprises an oil pressure~~ servo 14, a friction plate 74, and a hub ~~unit~~ 29. The friction plates 74 are intermeshed with plates splined To ~~and on~~ the outer circumferential ~~side~~ surface of the hub ~~unit~~ 29, ~~is disposed the friction plate 74 of the brake B1 which is capable being retained by the oil pressure servo 14 of the brake B1, by being splined. Also, this~~ The hub ~~unit~~ 29 is connected to ~~this~~ ring gear R1 at one axial end, and is ~~also~~ connected at its other axial end to a transmitting member 30 that transmits the rotation of the ring gear R1 when ~~this~~ clutch C3 is engaged, and that, in turn, ~~on the other side of this transmitting member 30~~ is connected to the sun gear S3 of the ~~above-mentioned~~ second planetary gear unit PU ~~is connected~~. In other words, the ring gear R1 and the sun gear S1 are constantly ~~in contact with one another~~ connected, with no clutch located between, and ~~the~~ rotation ~~can~~ is constantly ~~be~~ transmitted between S1 and R1.

~~On the other hand, on the other edge~~ At the front end of the input shaft 2 (left side of diagram) is a multi-disc clutch C1 (~~the~~ first clutch) ~~is configured~~ that includes a hydraulic ~~comprises an oil pressure~~ servo 11, a friction plate 71, ~~a drum shaped member 21 that forms~~ a clutch drum 21, and a hub ~~unit~~ 22. ~~Further, on the~~ A boss ~~unit~~

3b ~~that is elongated on the other~~ extends axially from the front side of the case 3 ~~on the opposite side from the above mentioned boss unit 3a~~, and is formed as a sleeve around ~~provided on~~ the input shaft 2, ~~in sleeve form, is configured~~ A multi-disc clutch C2 (~~the~~ "second clutch") includes a hydraulic ~~comprising an oil pressure~~ servo 12, friction plate 72, ~~a drum shaped member 23 that forms~~ a clutch drum 23, and a hub ~~unit~~ 24.

The oil chamber "a" of ~~this oil pressure~~ hydraulic servo 11 is ~~linked to the~~ connected to oil line 2b formed ~~on this above mentioned~~ in input shaft 2, ~~this~~ and oil line 2b is ~~linked through~~ connected to an oil line 93 ~~of~~ in the ~~above mentioned~~ boss ~~unit~~ 3b, ~~and this oil line 93 is linked through~~ Line 93 in turn, connects to an oil pressure control device, not illustrated. ~~In other words~~, Thus, the ~~above mentioned oil pressure~~ hydraulic servo 11 has an oil line ~~constructed from~~ for communication of oil chamber "a" with the oil pressure control device ~~not illustrated to the oil chamber "a" of the oil pressure servo 11~~, ~~by~~ formed with one set of seal rings 82 that form a seal between the boss ~~unit~~ 3b of the case 3 and the input shaft 2.

The oil chamber "a" of the ~~above mentioned oil pressure~~ hydraulic servo 12 is ~~linked through~~ connected to an oil line 94 ~~of~~ in the ~~above mentioned~~ boss ~~unit~~ 3b, ~~and this oil line 94 is linked through~~ which, in turn, connects to the oil pressure control device, not illustrated. ~~In other words, for the above mentioned~~ Thus, the oil chamber "a" of oil pressure servo 12 ~~an oil line is constructed from~~ is connected to the oil pressure control device ~~not illustrated to the oil chamber "a" of the oil pressure servo 12,~~ through a connection formed by one set of seal rings 83 that form a seal

between the boss unit 3b of the case 3 and the drum-shaped member 23.

The drum-shaped member 21 of the above-mentioned clutch C1 is connected to the input shaft 2, and has on the front edge of the inner circumference side of this drum-shaped member 21 is configured a friction plate 71, of the clutch C1 that is capable of engaging by the oil pressure servo 11, for the clutch C1, splined. On the inner circumference side of the friction plate 71 of this clutch C1 is configured a hub unit 22, splined, and this hub unit 22 is connected to the sun gear S2.

The drum-shaped member 23 of the above mentioned clutch C2 is also connected to the input shaft 2, and has on the front edge of the inner circumference side of this drum shaped member 23 is configured a friction plate 72 of the clutch C2 that is capable of engaging by the oil pressure servo 12, for the clutch C2, by being splined. On the inner circumference side of the friction plate 72 of this clutch C2 is configured a hub unit 24 by being splined, and this hub unit 24 is connected to the carrier CR2.

On the other hand, On the outer circumference side of the planetary gear unit PU is configured a multi-disc brake B2 that has an oil pressure servo 15, friction plate 75, and a hub unit 28. To the side plate of the carrier CR2 of this planetary gear unit PU is connected a hub unit 28 that

is splined to ~~the~~ friction plate 75 of the ~~above-mentioned~~ brake B2, and ~~further~~, this hub ~~unit~~ 28 is connected to the inner race of a one-way clutch F1. The sun gear S2 is meshed with the short pinion PS of ~~this~~ carrier CR2, and the ~~above-mentioned~~ sun gear S3 and ring gear R3 are meshed with the long pinion PL of ~~this~~ carrier CR2. Also, a linking ~~unit~~ 27 is connected to one ~~edge~~ of ~~this~~ ring gear R3, and ~~this~~ ring gear R3 ~~is linked~~ to the counter gear (output) unit 5. ~~via this linking unit 27.~~

As described above, the planetary gear PR and the clutch C3 are ~~configured on~~ one side ~~in the direction of the axis~~ of the planetary gear unit PU, and ~~also~~ the clutch C1 ~~and the clutch~~ C2 are ~~configured~~ on the other side ~~in~~ the ~~direction of the axis~~. Further, the counter gear 5 is ~~configured~~ between the planetary gear PR and the planetary gear unit PU, ~~in the direction of the axis~~. Further, the brake B1 is ~~configured~~ on the outer ~~circumference~~ side of the planetary gear, and the brake B2 is ~~configured~~ on the outer ~~circumference~~ side of the planetary gear unit PU.

~~Continuing, based on the above-mentioned construction,~~ the operations of the automatic transmission ~~device~~ 1 will be described, ~~following~~ Fig. 1, Fig. 2, and Fig. 3, ~~below.~~

~~Now,~~ the vertical axis of the speed line diagram ~~illustrated~~ in Fig. 3 indicate the ~~revolutions~~ of each ~~rotation~~ ~~component~~, and the horizontal axis indicates the

corresponding gear ratio of these ~~rotation~~ rotary elements components. ~~Further, regarding~~ In the second planetary gear unit PU section of this speed line diagram, the vertical axis ~~to the farthest horizontal edge~~ on the right side of Fig. 3 corresponds to sun gear S3, and ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axis corresponds in succession to the carrier CR2, the ring gear R3, and the sun gear S2. ~~Further, regarding~~ On the first planetary gear unit PR section of this speed line diagram, the vertical axis ~~to the farthest horizontal edge~~ on the right side of Fig. 3 corresponds to sun gear S1, and ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axis corresponds in succession to the ring gear R1 and the carrier CR1. Further, the width between these vertical axes are proportional ~~to the~~ inverse ~~of~~ to the number of teeth of ~~each of~~ the sun gears S1, S2, S3, and ~~to the~~ inverse ~~of~~ proportional to the number of teeth ~~of each~~ of the ring gears R1, R3. ~~Also,~~ The dotted line ~~in a~~ horizontal ~~direction~~ within the diagram illustrates ~~that the~~ rotation ~~is~~ transmitted from the transmitting member 30.

As illustrated in Fig. 1, the rotation of input shaft 2 is input to the ~~above mentioned~~ sun gear S2, by engagement of ~~engaging~~ the clutch C1. The rotation of input shaft 2 is input to the ~~above mentioned~~ carrier CR2, by engagement of ~~engaging~~ the clutch C2, and this carrier CR2 can be held against ~~fix the~~ rotation by ~~the retaining~~ engagement of brake B2, and ~~further, the~~ rotation is limited to ~~in~~ one direction ~~is~~

~~regulated~~ by the one-way clutch F1.

~~On the other hand, the above-mentioned~~ The sun gear S1 is connected to the input shaft 2 by engag~~ing~~ement of the clutch C3 for receipt of ~~and~~ the input rotation, ~~of this input shaft 2 is input.~~ Further, the ~~above-mentioned~~ carrier CR1 is connected to the case 3 thereby fixed against and ~~the~~ rotation ~~thereof is fixed, and then~~ so that the rotation of the input shaft 2 ~~is~~ input to ~~this~~ the sun gear S1 causes the ring gear R1 ~~therefore~~ to rotate at a reduced speed. The reduced speed rotation of this ring gear R1 is input to the sun gear S3 via the transmitting member 30. Further, when the clutch C3 is not engaged, and the brake B1 is ~~retained~~ engaged, the ~~rotation of the~~ sun gear S3 is fixed against rotation via this transmitting member 30.

~~Also,~~ The rotation of the ~~above-mentioned~~ ring gear ~~R2~~ R3 is output to the above-mentioned counter gear 5, and ~~is~~ from the counter gear 5 to ~~output~~ to the drive wheel ~~not illustrated via this counter gear 5,~~ via a counter shaft unit, not illustrated, and To a differential unit.

~~At~~ In first speed forward within the D (drive) range, as illustrated in Fig. 2, the clutch C1 and ~~a~~ one-way clutch F1 are engaged. Then, as illustrated in Fig. 3, the rotation of input shaft 2 is input to the sun gear S2 via the clutch C1, and the rotation of the carrier CR2 is ~~regulated in~~ restricted to one direction (the forward rotation direction), in other words, the carrier CR2 is prevented from rotating in the opposite direction ~~and is fixed~~. Further, the rotation of input

shaft 2 that is input to the sun gear S2 is output to the ring gear R3 via the fixed carrier CR2, and the forward rotation for first speed forward is output from the counter gear 5.

~~Now~~ When downshifting (when coasting), the brake B2 is ~~retained~~ engaged and carrier CR2 is fixed thereby, and ~~the above-mentioned state of~~ first speed forward is maintained ~~while preventing the forward rotation of this carrier CR2.~~ Further, ~~at~~ in this first speed forward, the one-way clutch F1 prevents the carrier CR2 from rotation in the opposite direction and allows forward rotation, and therefore, switching from a non-running range to a running range and achieving the first speed forward can be accomplished more smoothly by the automatic engag~~ing~~ement of the one-way clutch.

~~At~~ In second speed forward within ~~the~~ D (drive) range, as illustrated in Fig. 2, the clutch C1 is engaged and the brake B1 is ~~retained~~ also engaged. Then, as illustrated in Fig. 3, the rotation of input shaft 2 is input to the sun gear S2 via the clutch C1, and the sun gear S3 is fixed by ~~retaining~~ engagement of the brake B1. ~~By doing so~~ In this state, the carrier CR2 slightly reduces the rotation~~al~~ speed, ~~and~~ the rotation of input shaft 2 that was input ~~in~~ to the sun gear S2 is output to the ring gear R3 via the carrier CR2 at this reduced rotation~~al~~ speed, and the forward rotation for second speed forward is output from the counter gear 5.

In At third speed forward within the D (drive) range, as illustrated in Fig. 2, the clutch C1 and the clutch C3 are engaged. Then, as illustrated in Fig. 3, the rotation of input shaft 2 is input to the sun gear S2 via the clutch C1. ~~Further,~~ also The rotation of input shaft 2 is input to the sun gear S1 via the clutch C3, ~~and~~ the ring gear R1 reduces the rotation speed ~~by the~~ due to non-rotation of the fixed carrier CR1, and the reduced speed ~~reduction speed rotation~~ of this ring gear R1 is output to the sun gear S3 via the transmitting member 30. Then, the carrier CR2 ~~has~~ will have a slightly increased ~~reduced~~ rotational speed compared to the ~~reduced~~ rotation speed of ~~this~~ sun gear S3 because of the rotation of the input shaft 2 input to the sun gear S2 and the reduced speed rotation of the sun gear S3. Further, the rotation of the input shaft 2 ~~that was~~ input to the sun gear S2 is output to the ring gear R3 via the carrier CR2 at ~~this~~ the reduced rotational speed, and the forward rotation for third speed forward is output from the counter gear 5. In this case, because the sun gear S3 and the ring gear R1 ~~are~~ rotate at a reduced ~~rotation~~ speed, the ~~above-mentioned~~ transmitting member 30 ~~performs~~ transmits a relatively large torque ~~transmission.~~

In At fourth speed forward within the D (drive) range, as illustrated in Fig. 2, the clutch C1 and the clutch C2 are engaged. Then, as illustrated in Fig. 3, the rotation of the input shaft 2 is input to the sun gear S2 via the clutch C1, and into the carrier CR2 via the clutch C2 to establish ~~Therefore,~~

~~by the rotation of the input shaft 2 input to the sun gear S2 and the rotation of input shat 2 input to the carrier CR2, in other words, in the~~ a state of directly coupled rotation, and the rotation of the input shaft 2 is output as is ~~as~~ to the ring gear R3, and the forward rotation for fourth speed forward is output from the counter gear 5.

~~At~~ In fifth speed forward within the D (drive) range, as illustrated in Fig. 2, the clutch C2 and the clutch C3 are engaged. Then, as illustrated in Fig. 3, the rotation of the input shaft 2 is input to the carrier CR2 via the clutch C2 ~~Further, the rotation of the input shaft 2 is input~~ and to the sun gear S1 via the clutch C3, and the ring gear R1 rotates at a reduced ~~rotation~~ speed ~~by the fixed carrier CR1~~, and the ~~reduced~~ rotation of ~~this~~ ring gear R1 is output at this reduced speed to the sun gear S3 via the transmitting member 30. Then, overdrive rotation due to the reduced rotation speed of the sun gear S3 and input to the carrier CR2 ~~wherein~~ of the rotation of the input shaft 2, ~~is input,~~ is output to the ring gear R3, and the forward rotation for fifth speed forward is output from the counter gear 5. In this case, similar to the case of the ~~above-~~ ~~mentioned~~ third speed forward, because the sun gear S3 and the ring gear R1 are rotating at a reduced ~~rotation~~ speed, the ~~above-mentioned~~ transmitting member 30 ~~performs~~ transmits a relatively large torque ~~transmission~~.

~~At~~ In sixth speed forward within the D (drive) range, as

illustrated in Fig. 2, the clutch C2 is engaged and the brake B1 is ~~retained~~ engaged. Then, as illustrated in Fig. 3, the rotation of the input shaft 2 is input to the carrier CR2 via the clutch C2, and the sun gear S3 is fixed by ~~retaining with~~ engagement of the brake B2. This causes overdrive rotation ~~greater~~ at a speed higher than that of the above-mentioned fifth speed forward, derived from the rotation of the input shaft 2 input to the carrier CR2 ~~and~~ with the ~~fixed~~ sun gear S3, ~~and is~~ fixed to be output to the ring gear R3, and the forward rotation for sixth speed forward is output from the counter gear 5.

~~At~~ In first speed reverse within ~~an~~ R (reverse) range, as illustrated in Fig. 2, the clutch C3 ~~is engaged~~ and the brake B2 ~~is retained~~ are engaged. Then, as illustrated in Fig. 3, the rotation of the input shaft 2 is input to the sun gear S1 via the clutch C3, and the ring gear R1 rotates at a decreased speed ~~rotation by~~ with the fixed carrier CR1, and the ~~reduced~~ rotation of this ring gear R1 is output to the sun gear S3 via the transmitting member 30. Further, the carrier CR2 is fixed by ~~retaining with~~ engagement of the brake B2. Then, the ~~reduced~~ rotation of the sun gear S3 at reduced speed ~~and~~ with the fixed carrier CR2 is output to the ring gear R3 as ~~an opposite~~ reverse direction rotation, and the ~~opposite~~ reverse direction rotation for first speed reverse is output from the counter gear 5. In this case, similar to the case of the ~~above-mentioned~~ third speed forward ~~or~~ and fifth speed forward, because the sun gear S3 and the ring gear R1

are at a reduced rotation, the above-mentioned transmitting member 30 performs a relatively large torque, transmission.

At the P (parking) range and the N (neutral) range, particularly the clutch C1, clutch C2, and clutch C3 are released, the transmission movement between the input shaft 2 and the counter gear 5 is disconnected, and the automatic transmission device 1_1 as a whole is in an idle state (neutral state).

As illustrated in Fig. 2 and Fig. 3, at first speed forward, second speed forward, fourth speed forward, and sixth speed forward, at the planetary gear PR, the rotation of the sun gear S3 is input to the ring gear R1 via the transmitting member 30, and further, because the clutch C3 is released, as illustrated in Fig. 3, the sun gear S1 rotates based on the rotation of each speed level of this ring gear R1 and the fixed carrier CR1.

As described above, according to the automatic transmission device 1_1 relating to the present invention, the planetary gear PR and the clutch C3 are configured on one side in the axial direction of the planetary gear unit PU, and the clutch C1 and the clutch C2 are configured on the other side in the axial direction of the planetary gear unit PU, therefore an automatic transmission can be provided that will achieve six forward speeds and one reverse speed with direct coupling at fourth speed forward. For example,

compared to ~~the case~~ a transmission wherein the clutch C1 or clutch C2 is ~~configured~~ located between the first planetary gear unit PR and the second planetary gear unit PU, the first planetary gear unit PR and the second planetary gear unit PU can be ~~configured~~ located close together, and the transmitting member 30 ~~for~~ which transmitting the reduced speed rotation can be made relatively short. Therefore, the automatic transmission can be made more compact and lightweight, and further, because the inertia (force ~~of inertia~~ inertial) can be reduced, the controllability of the automatic transmission can be improved, and the occurrence of speed change shock can be reduced.

Further, the clutch C3 is ~~configured~~ located on one axial side ~~in the axial direction~~ of the second planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured~~ located on the other axial side ~~in the axial direction~~ of the second planetary gear unit PU. Therefore, compared to the case wherein for example three clutches C1, C2, and C3 are ~~configured~~ arranged on one side of the second planetary gear unit PU, the construction of ~~the~~ oil lines (for example, 2a, 2b, 92, 93, 94) ~~for~~ to provide oil to the ~~oil pressure~~ hydraulic servos 11, 12, and 13 for these clutches C1, C2, C3 ~~can be made easily~~ becomes easier, ~~and~~ the manufacturing process ~~can be~~ is simplified and the costs ~~brought down~~ reduced.

Further, because the ~~oil pressure~~ hydraulic servos 11 and 13 are provided on the input shaft 2, ~~one~~ two sets of seal rings 81 and 82 seal the case 3 ~~and supply oil~~ to the oil lines 2a, and

2b provided within input shaft 2, and therefore oil can be supplied to the oil compartment of ~~oil pressure~~ hydraulic servos 11 and 13 without providing seal rings between, for example, the input shaft 2 and the ~~oil pressure~~ hydraulic servos 11 and 13. Further, ~~oil pressure~~ the hydraulic servo 12 can ~~supply~~ be supplied with oil from the boss ~~unit~~ 3b ~~provided from the case 2~~, without passing through other units for example, ~~in other words, can supply oil~~ by ~~providing~~ provision of the one set of seal rings 83. Therefore, oil can be supplied simply by providing one set of seal rings 81 and 82, 83 each for the oil pressure servos 11, 12, and 13, and because sliding resistance from ~~the~~ seal rings ~~can be~~ is minimized, ~~and therefore~~ the efficiency of the automatic transmission ~~can be~~ is improved.

~~Further,~~ The clutch C1 is a clutch that engages at relatively slow to medium speed ~~levels of~~, i.e. in first speed forward, second speed forward, third speed forward, and fourth speed forward, and ~~therefore then this clutch C1~~ is released at fifth speed forward, sixth speed forward, or first speed reverse, which are relatively high speed ~~levels~~. The hub ~~unit~~ 22 that connects ~~in particular this~~ clutch C1 and sun gear S2 rotates at a relatively high ~~rotation~~ speed or in reverse ~~rotation~~ (see Fig. 3), ~~and~~ On the other hand, with the transmitting member 30 rotating at a reduced speed in ~~rotation at~~ fifth speed forward or first speed reverse, and ~~there may be cases wherein~~ when the transmitting member is fixed at sixth speed

forward, ~~and~~ the ~~rotation~~ difference between the hub unit 22 and the transmitting member 30 may become large. However, because this clutch C1 is located on the opposite side of ~~the planetary gear PR via~~ the planetary gear unit PU, the hub unit 22 and the transmitting member 30 can be ~~configured~~ spaced apart, and, compared with the case wherein for example those units are configured in ~~contact with~~ a multi-axial construction, the decreased in efficiency of the automatic transmission, ~~resulting~~ which would otherwise result from the relative rotation occurring because of friction between those units, can be prevented.

Further, since the counter gear 5 is ~~configured in the~~ axially ~~direction between~~ intermediate the second planetary gear unit PU and the first planetary gear unit PR, the counter gear 5 can be ~~configured~~ in approximately the axial center ~~in the axial direction~~ of the automatic transmission. For example, when the automatic transmission is mounted on the vehicle, ~~enlarging towards~~ enlargement in one axial direction ~~of the axis~~ (particularly in the rear direction ~~when~~ where the input ~~side~~ from the drive source is at the axial front ~~direction~~) can be ~~prevented~~ avoided because the counter gear 5 is mounted ~~to match~~ adjacent the drive wheel transmission mechanism. Because of this, particularly in the case of an FF vehicle, the interference ~~toward~~ with the front wheels is reduced, ~~and the~~ mountability on a vehicle ~~can be~~ is improved, ~~such~~ and the steering angle ~~being greatly~~ is improved, ~~for example~~.

Further, in the event that the ~~oil pressure~~ hydraulic servo 13 ~~is~~ adjoins

~~configured adjoined to~~ the first planetary gear unit PR for example, and the hub unit 26 ~~is made to be~~ serves as the cylinder ~~unit~~ for the ~~oil pressure~~ hydraulic servo 13, ~~the necessity arises~~ it becomes necessary to provide one set of seal rings between the hub ~~unit~~ 26 and the input shaft 2. However, the ~~oil pressure~~ hydraulic servo 13 of the clutch C3 is ~~configured~~ located on the ~~opposite~~ axially opposite side of the friction plates 73 ~~from~~ and the planetary gear PR ~~in the axial direction~~, therefore, seal rings are not provided, ~~in other words~~, and thus the number of seal rings ~~can be~~ is reduced, sliding resistance ~~can be~~ is reduced, and by doing so, the efficiency of the automatic transmission ~~can be~~ is improved.

~~Further~~, Because the automatic transmission ~~device~~ 1_1 according to the ~~present~~ first embodiment ~~is a transmission device that~~ is directly coupled ~~at~~ in fourth speed forward. ~~Therefore~~, ~~at~~ in fifth speed forward and in sixth speed forward, the gear ratio can be ~~specified at~~ a high ratio, and particularly when ~~mounted on a vehicle, in the event that~~ the vehicle is running at a high speed, the engine ~~revolutions~~ speed can be ~~lowered, and this contributes~~ reduced to ~~the~~ quiet~~ness of~~ the vehicle while running at a high speed.

~~In order to solve the above described problems, proposals have been made such as those in~~ Japanese Unexamined Patent Application Publication No. 8-68456, ~~However, the article in this Publication has~~ proposes a construction wherein a clutch is ~~configured on~~ located in the ~~line that transmits~~ path of

~~the~~ reduced ~~rotation of~~ the reducing planetary gear to the ~~rotation component~~ of the planetary gear unit, and because ~~the line that transmits this reduced rotation is a line wherein a~~ large torque ~~is input~~, the clutch or members that transmit the torque must be constructed so as to withstand this large torque. In other words, the number of friction members ~~on~~ a clutch must be increased, or the size thereof increased, or the ~~oil pressure~~ servo for ~~pressurizing~~ the ~~friction member~~ must be made larger. Further, because a brake must be ~~configured~~ to ~~retain~~ the ~~rotation component~~ of the planetary gear unit, this automatic transmission ~~was~~ ~~with regard to being~~ compact ~~in size~~. Therefore, it is an object of the present embodiment to provide an automatic transmission that solves the above-mentioned problems, by constructing a compact clutch and brake in the area of the reducing planetary gear.

Therefore, ~~according to~~ the automatic transmission ~~device~~ 1_1 ~~relating to~~ the present embodiment, the clutch C3 is located between the input shaft 2 and the sun gear S1, and therefore, compared to the case wherein the clutch C3 is located for example between the ring gear R1 and the sun gear S3, the ~~burden~~ on the clutch C3 ~~can be~~ decreased, and the clutch C3 can be made more compact. Further, because the friction member and ~~oil pressure~~ servo of the clutch C3 can be made smaller, these can be ~~configured~~ on the inner

~~circumference~~ side ~~in the radial direction~~ of the brake B1, and the automatic transmission can be made more compact.

~~[~~Second Embodiment~~]~~

~~The~~ second embodiment, which is a partial modification of the first embodiment, will be described with reference to Fig. 4. Fig. 4 is a schematic cross-sectional diagram ~~illustrating~~ the automatic transmission ~~device of an automatic transmission relating to~~ the second embodiment. ~~Now,~~ components of the second embodiment which are the same as those of the first embodiment ~~will be~~ denoted ~~with~~ the same reference numerals, and description thereof omitted, except for partial modifi~~cations~~.

As Fig. 4 illustrates, the automatic transmission ~~device~~ 1_2 of the ~~automatic transmission relating to the~~ second embodiment has the input ~~side~~ and output ~~side~~ ~~backwards from that~~ of the automatic transmission ~~device~~ 1_1 ~~of the automatic transmission~~ of the first embodiment (see Fig. 1). ~~Further~~, the ~~actions of~~ the first speed forward through the sixth speed forward and the first speed reverse ~~is~~ similar (see Fig. 2 and Fig. 3).

~~As described above, according to~~ the automatic transmission ~~device~~ 1_2 ~~relating to~~ the ~~present invention~~, the planetary gear PR and the clutch C3 are ~~configured on~~ one ~~side in the~~ axial ~~direction~~ of the planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured on~~

the other ~~side in the~~ axial ~~direction~~ of the planetary gear unit PU, and therefore directly coupled ~~when at~~ fourth speed forward, and can ~~achieve~~ six forward speeds and one reverse speed. The planetary gear PR and the planetary gear unit PU can be ~~configured~~ closer together, compared to the case wherein for example the clutch C1 and the clutch C2 are ~~configured~~ between the planetary gear PR and the planetary gear unit PU, and the transmitting member 30 for transmitting the reduced rotation can be made relatively ~~short~~. Therefore, the automatic transmission can be made compact and lightweight, and further, because the inertia (force ~~of inertia~~) can be reduced, the controllability of the automatic transmission can be improved, and the occurrence of speed change shock can be reduced.

Further, the clutch C3 is ~~configured on~~ one side ~~in the axial direction~~ of the planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured on~~ the other side ~~in the axial direction~~ of the planetary gear unit PU, ~~therefore~~ compared to the case wherein the three clutches C1, C2, and C3 are ~~configured~~ on one side of the planetary gear unit PU for example, the construction of ~~an~~ oil line (for example, 2a, 2b, 92, 93, 94) ~~to~~ provide oil to the ~~oil pressure~~ servos 11, 12, and 13 for these clutches C1, C2, C3 can be made easily, ~~and~~ the manufacturing process can be simplified and the cost brought down.

Further, because the oil pressure servos 11 and 13 are provided on the input shaft 2, one set of seal rings 81 and 82 seal the case 3 and supply oil to the oil lines 2a, and 2b provided within input shaft 2, and therefore oil can be supplied to the oil compartments of ~~oil pressure~~ hydraulic servos 11 and 13 without providing seal rings between, for example, the input shaft 2 and the ~~oil pressure~~ hydraulic servos 11 and 13. Further, the ~~oil pressure~~ hydraulic servo 12 can receive supply of oil directly from the boss ~~unit~~ 3b ~~provided from the case 3~~, without passing through other units, ~~for example, in other words, can supply oil by providing~~ utilizing only one set of seal rings 83. Therefore, oil can be supplied simply by providing one set of seal rings 81 and 82, 83 each for the oil pressure servos 11, 12, and 13, ~~and~~ sliding resistance from the seal rings can be minimized, and therefore the efficiency of the automatic transmission can be improved.

~~Further,~~ Because the clutch C1 ~~is a clutch that~~ engages at relatively slow to medium speeds, i.e. ~~levels of~~ first speed forward, second speed forward, third speed forward, and fourth speed forward, and ~~therefore then this clutch C1~~ is released at fifth speed forward, sixth speed forward, ~~or~~ and first speed reverse, which are relatively high speeds ~~levels~~, the hub unit 22 that connects ~~in particular~~ this clutch C1 ~~and~~ will sun gear S2 rotates at a relatively high ~~rotation~~ speed or in reverse ~~rotation~~ (see Fig. 3), ~~and while~~ because the transmitting

member 30 reduces speed of rotation in fifth speed forward and first speed reverse, and because there may be cases wherein the transmitting member is fixed in sixth speed forward, the rotational speeds of difference between the hub 22 and the transmitting member 30 may become large. However, because clutch C1 is located on the opposite side of the planetary gear unit PR from the second planetary gear unit PU, the hub 22 and the transmitting member 30 can be spaced apart, and compared with the case wherein for example those units are in contact with a multi-axial design, the decrease in efficiency of the automatic transmission resulting from the relative rotation occurring because of friction between these units can be prevented.

Further, because the counter gear 5 is located in the axial intermediate direction between the first planetary gear unit PR and the second planetary gear unit PU, the counter gear 5 can be located in approximately the axial center of the automatic transmission. For example, when the automatic transmission is mounted on a vehicle, enlargement in one axial direction which connects with the drive source is the front "direction") is not necessary because the counter gear 5 is mounted adjacent the drive wheel transmission mechanism. Because of this, particularly in the case of an FF vehicle, interference with the front wheels is reduced, and the

mountability on a vehicle ~~can be~~ improved, such that the steering angle ~~being~~ is greatly improved, for example.

Further, in the event that the ~~oil pressure~~ hydraulic servo 13 is ~~configured~~ located adjoining ~~to~~ the first planetary gear unit PR, for example, and the hub ~~unit~~ 26 ~~is made to be~~ serves as the cylinder ~~unit for~~ of the ~~oil pressure~~ hydraulic servo 13, ~~the necessity arises~~ it becomes necessary to provide one set of seal rings between the hub ~~unit~~ 26 and the input shaft 2. However, in this second embodiment the ~~oil pressure~~ hydraulic servo 13 of the clutch C3 is ~~configured~~ located on the ~~opposite~~ axially opposite side of the friction plates 73 ~~from~~ the first planetary gear unit PR ~~in the axial direction~~, and therefore seal rings are ~~not provided~~ omitted, ~~in other words,~~ the total number of seal rings ~~can be~~ is reduced, sliding resistance ~~can be~~ is reduced, and ~~by doing so,~~ thus the efficiency of the automatic transmission ~~can be~~ is improved.

Further, the automatic transmission ~~device~~ 1_2 ~~according to~~ of the present embodiment ~~is a transmission device that~~ is directly coupled ~~at~~ in fourth speed forward. Therefore, ~~at~~ in fifth speed forward and sixth speed forward, the gear ratio can be ~~specified at~~ a high ratio, and particularly when ~~mounted on a vehicle, in the event that~~ the vehicle is running at a high speed, the engine ~~revolutions~~ speed can be lowered, ~~and this contributes to the quietness of~~ allowing the vehicle ~~while~~ to run more quietly at high speed.

~~In order to solve the above-described problems, proposals have been made such as those in~~ Japanese

Unexamined Patent Application Publication No. 8-68456 proposes ~~However, the product in this Publication has~~ a construction wherein a clutch is ~~configured on~~ located in the line that transmits the reduced speed rotation of the reducing planetary gear unit to the ~~rotation component~~ rotary element of the second planetary gear unit, and because the line that transmits this reduced speed rotation ~~is a line wherein~~ bears a large torque ~~is input~~, the clutch or members that transmit the torque must be constructed so as to withstand this large torque. In other words, the number of friction members ~~on~~ of a clutch must be increased, or the size thereof increased, or the ~~oil pressure~~ hydraulic servo for ~~pressurizing~~ engaging the friction members must be made larger. Further, because a brake must be ~~configured~~ able to ~~retain~~ brake the rotation component ry element of the second planetary gear unit, this automatic transmission ~~was~~ could not be made ~~with regard to being~~ sufficiently compact ~~in size~~. Therefore, by constructing a compact clutch and brake in the area of the reducing planetary gear unit, ~~it is an object of the present~~ this second embodiment ~~to~~ provide an automatic transmission that solves the above-mentioned problems.

~~Therefore, according to~~ In the automatic transmission ~~device relating to the present~~ of this second embodiment, because the clutch C3 is located between the input shaft 2 and the sun gear S1, ~~and therefore,~~ compared to the case wherein the clutch C3 is located for example between the ring gear R1 and the sun gear S3, the ~~burden~~ load on the clutch C3 can be decreased, and

the clutch C3 can be made more compact. Further, because the friction members and ~~oil pressure~~ hydraulic servo of the clutch C3 can be made smaller, they can be ~~configured~~ located on the radially inner ~~circumference~~ side ~~in the radial direction~~ of the brake B1, and the automatic transmission can be made more compact.

Third Embodiment

The third embodiment, which is a partial modification of the first embodiment will be described with reference to Fig. 5 through Fig. 7. ~~Fig. 5 is a schematic cross-sectional diagram~~ illustrating the automatic transmission device of an automatic transmission relating to the third embodiment, Fig. 6 is a operational table of an automatic transmission relating to the third embodiment, and Fig. 7 is a speed line diagram of an ~~automatic transmission relating to the third embodiment. Now,~~ Components of the third embodiment which are the same as those of the first embodiment ~~will be~~ are denoted ~~with~~ by the same reference numerals in Figs. 5-7, and description thereof omitted, except for those components partially ~~modifications~~ modified.

As Fig. 5 illustrates, the automatic transmission ~~device~~ 1_3 of the ~~automatic transmission relating to the~~ third embodiment differs from the first embodiment in ~~changes~~ the configuration of the planetary gear unit PR, ~~and further, configured~~ in that a brake B3 (the first brake) ~~in place of~~ replaces the clutch C3, and ~~changed~~ in that the carrier CR1 of the planetary gear first unit PR is modified so as to be capable of being

fixed by the brake B3, ~~as compared to that of the automatic transmission device 1 of the automatic transmission of the first embodiment (see Fig. 1).~~

In this third embodiment the brake B3 is located on the opposite side of the second planetary gear unit PU (right side of diagram) of the first planetary gear unit PR. This brake B3 comprises a hydraulic servo 16, friction plates 76, and a hub 33. Further, the brake B1 is located radially outward of the brake B3.

The hub 33 of brake B3 is connected to one side plate of the carrier CR1, and carrier CR1 is rotatably supported by the input shaft 2 or the boss 3a, ~~so as to be capable of rotating~~. Further, the sun gear S1 is connected to the input shaft 2. Also, the friction plates 74 of the brake B1 are splined to the outer circumferential surface of the ring gear R1, and also this ring gear R1 is connected to the sun gear S3 via the transmitting member 30, ~~and the sun gear S3 is connected via this transmitting member 30.~~ In other words, the ring gear R1 and the sun gear S1 are constantly connected with one another, with no clutch located there between, for constant transmission of the rotation, ~~can constantly be transmitted.~~

~~Continuing, based on the above-mentioned construction,~~ the operations of the automatic transmission ~~device~~ 1_3 will now be described with reference to Fig. 5, Fig. 6, and Fig. 7 below.

~~Now,~~ Similar to the above-mentioned first embodiment, the vertical axes of the speed line diagram illustrated in Fig. 7 indicate the ~~revolutions~~ speed of rotation of each ~~rotation component~~ rotary element, and the horizontal axis indicates the corresponding gear ratio of these ~~rotation components~~ rotary elements. ~~Further, regarding~~ In the second planetary gear unit PU section of this speed line diagram, the vertical axis ~~to the farthest horizontal edge~~ at the right side of Fig. 7 corresponds to sun gear S3, and ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axes corresponds to the carrier CR2, the ring gear R3, and the sun gear S2. ~~Further, regarding~~ In the first planetary gear unit PR section of this speed line diagram, the vertical axis ~~to the farthest horizontal edge~~ at the right side of Fig. 7 corresponds to sun gear S1, and ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axes corresponds to the ring gear R1 and the carrier CR1. Further, the widths between these vertical axes are inversely proportional to the ~~inverse of the~~ number of teeth of each of the sun gears S1, S2, S3, and to the ~~inverse of the~~ number of teeth of each of the ring gears R1, R3. Also, the dotted line in a horizontal direction within the diagram ~~illustrates that the~~ represents rotation is transmitted from the transmitting member 30.

As illustrated in Fig. 5, the ~~above-mentioned~~ carrier CR1 is fixed to the case 3 by engagement of the brake B3 ~~retaining~~.

Further, the rotation of the input shaft 2 is input to the sun gear S1, and the ~~above-mentioned~~ ring gear R1 rotates ~~decreases~~ at a ~~rotation~~ speed reduced from that ~~based on the rotation~~ of the input shaft 2 which ~~that~~ is input to ~~this~~ sun gear S1, with ~~by this~~ carrier CR1 being fixed. Thus ~~In other words~~, the reduced speed rotation of the ring gear R1 is input to the sun gear S3 via the transmitting member 30, by engagement of ~~engaging~~ the brake B3.

~~By doing so,~~ As Fig. 6 and Fig. 7 illustrate, ~~regarding~~ in the first planetary gear unit PR, ~~at~~ in third speed forward, fifth speed forward, and first speed reverse, the rotation of the input shaft 2 is input to the sun gear S1 by engaging ~~retaining~~ the brake B3, to fix the carrier CR1 ~~is fixed~~, and the reduced speed rotation is output to the ring gear R3 by the rotation of the sun gear S1 which is input from ~~wherein the rotation of~~ the input shaft 2 ~~is input~~, and the reduced speed rotation is input to the sun gear S3 via the transmitting member 30. Because ~~In this case,~~ the ring gear R1 and the sun gear S3 are rotating at a reduced speed, ~~therefore the above-mentioned~~ transmitting member 30 transmits ~~performs~~ a relatively large torque ~~transmission~~. On the other hand, in ~~at~~ first speed forward, second speed forward, fourth speed forward, and sixth speed forward, the rotation of the sun gear S3 is input to the ring gear R1 via the transmitting member 30, and further, because the brake B3 is released, as Fig. 7 illustrates, the carrier CR1 rotates at a speed based on both ~~each~~ the ~~rotation within~~ the rotational speed ~~level~~ of ~~this~~ ring gear R1 and the

rotational speed of sun gear S1 ~~of the rotation of~~ input from the input shaft 2.

~~Now, the actions~~ Operations other than those of the ~~above-mentioned~~ first planetary gear PR ~~above described~~ described above are similar to those of the first embodiment (see Fig. 2 and Fig. 3), and accordingly, description thereof will be omitted.

As described above, ~~according to~~ in the automatic transmission ~~device~~ 1_3 ~~relating to the present invention~~ of this third embodiment, the planetary gear PR and the brake B3 are ~~configured~~ located on one axial side ~~in the axial direction~~ of the second planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured~~ located on the other axial side ~~in the axial direction~~ of the second planetary gear unit PU. Therefore, ~~the an~~ automatic transmission can ~~be~~ provide~~d~~ ~~that will achieve~~ all six forward speeds and one reverse speed, with direct coupling ~~at~~ in fourth speed forward. For example, compared to the case wherein ~~a~~ the clutch C1 or clutch C2 is ~~configured~~ located between the first planetary gear unit PR and the second planetary gear unit PU, the first planetary gear unit PR and the second planetary gear unit PU can be ~~configured~~ located close together, and the transmitting member 30 for transmitting the reduced rotation can be made relatively short. Therefore, the automatic transmission can be made more compact and lightweight, and further, because the inertia (force ~~of inertia~~) can be reduced, the controllability of the automatic transmission can be improved, and the occurrence of speed change shock can be reduced.

Further, because the ~~oil pressure~~ hydraulic servo 11 is provided on the input shaft 2, one set of seal rings 82 forms a seal with the case 3 and provides a connection for supply of oil ~~to~~ from the oil lines 2b provided within input shaft 2, ~~and therefore oil can be supplied~~ to the oil compartment of ~~oil pressure~~ hydraulic servo 11 without ~~providing~~ any seal rings between, for example, the input shaft 2 and the ~~oil pressure~~ hydraulic servo 11. Further, ~~oil pressure~~ hydraulic servo 12 can receive supply of oil directly from the boss ~~unit~~ 3b ~~provided from the case 3,~~ formed without passing through other units for example. In other words, ~~can~~ supply of oil is by providing a connection with one set of seal rings 83. Therefore, oil can be supplied simply by providing one set of seal rings 82, 83 for each of the ~~oil pressure~~ hydraulic servos 11, 12, ~~and~~ sliding resistance from the seal rings can be minimized, and therefore the efficiency of the automatic transmission can be improved.

Further, because the clutch C1 ~~is a clutch that~~ engages at relatively slow to medium speeds ~~levels of~~ i.e. first speed forward, second speed forward, third speed forward, and fourth speed forward, and ~~therefore than this clutch C1~~ is released in fifth speed forward, sixth speed forward, ~~or~~ and first speed reverse, which are relatively high speed levels, the hub unit 22 that connects ~~in particular~~ this clutch C1 and sun gear S2 rotates at a relatively high speed ~~rotation~~ or in reverse ~~rotation~~ (see Fig. 7). ~~and on the other hand~~ Because the transmitting member 30 rotates at a reduced speed in ~~rotation at~~ fifth speed

forward ~~or~~ and in first speed reverse, ~~and~~ because there may be cases wherein the transmitting member is fixed ~~at~~ in sixth speed forward, ~~and~~ the speed as rotation difference in between the hub ~~unit~~ 22 and the transmitting member 30 may become large. However, because the present invention locates this clutch C1 ~~is located~~ on the ~~opposite~~ side of ~~the~~ first unit planetary gear PR ~~via~~ second planetary gear unit PU, opposite the hub ~~unit~~ 22 and the transmitting member 30 can be ~~configured~~ spaced further apart, ~~and~~ as compared with the case wherein for example those units are ~~configured~~ in contact with a multi-axial construction, and the decreased in efficiency of the automatic transmission resulting from the relative rotation occurring because of friction between those units can be prevented.

Further, due to the counter gear 5 being ~~configured in~~ located the axial ~~direction between~~ intermediate second planetary gear unit PU and the first planetary gear unit PR, the counter gear 5 can be ~~configured~~ located at ~~in~~ approximately the axial center ~~in the axial direction~~ of the automatic transmission. For example, when the automatic transmission is mounted on ~~the~~ a vehicle, enlargement in ~~towards~~ one axial direction ~~of the axis~~ (particularly in the rear direction when the ~~input~~ side which receives input from the drive source is the front ~~direction) can be prevented~~ becomes unnecessary because the counter gear 5 is mounted to ~~match~~ adjoin the drive wheel transmission mechanism. Because of this, particularly in the case of an FF vehicle, ~~the~~ interference ~~toward~~ with the front wheels is reduced, ~~and~~ the mountability on a vehicle can be improved, ~~such~~ and the steering

angle ~~being~~ can be greatly improved ~~, for example~~.

Further, because the reduced ~~rotation~~ speed output to the ~~second~~ planetary gear unit PU from the ~~planetary~~ first gear PR is ~~engaged~~ controlled by engagement and disengaged ~~by~~ of the brake B3, the number of parts (for example ~~drum-shaped members~~ and so forth) can be reduced compared to the case where ~~in~~, for example, a clutch C3 is provided. Further, the brake B3 can ~~configure an~~ be operated by received oil ~~line~~ directly from a line in the case 3, and therefore the construction of an oil line can be simplified as compared to the case wherein, for example, a clutch C3 is provided.

Further, the automatic transmission ~~device~~ 1_3 according to ~~the present~~ this third embodiment is ~~A transmission device that is~~ directly coupled ~~at~~ in fourth speed forward. Therefore, ~~at~~ in fifth speed forward and sixth speed forward, the gear ratio can be ~~specified at~~ a high ratio, and particularly ~~when~~ for high ~~mounted on a vehicle, in the event that the~~ vehicle ~~is running at a high~~ speed, the engine ~~revolutions~~ speed can be lower, and this ~~contributes to~~ makes the ~~quietness of the~~ vehicle more quiet while running at a high speed.

~~In order to solve the above-described problems, proposals have been made such as those in~~ Japanese Unexamined Patent Application Publication No. 8-68456 ~~However, the product in this Publication has~~ proposes a construction wherein a clutch is ~~configured~~ located on the line that transmits the reduced ~~rotation~~ speed of the reducing planetary gear set to the

~~rotation component~~ of the planetary gear unit, and because the line that transmits this reduced rotation ~~is a line wherein a large~~ torque is input, this clutch or ~~members~~ that must transmit the ~~torque~~ must be constructed so as to withstand ~~this large~~ torque. In other words, the number of friction members ~~on~~ a clutch must be increased, ~~or~~ the size thereof increased, or the ~~oil pressure~~ servo for ~~procuring~~ the ~~friction member~~ must be made larger. Further, since a brake must be ~~configured~~ to ~~retain~~ the ~~rotation component~~ of the planetary gear unit, this automatic transmission ~~was~~ ~~insufficient with regard to being compact in size~~. ~~Therefore,~~ By ~~constructing~~ a compact clutch and brake in the area of the reducing planetary gear, ~~it is an object of the present~~ embodiment ~~to~~ provide an automatic transmission that ~~solves the above mentioned problems~~.

~~Therefore, according to~~ the automatic transmission ~~device~~ 1_3 ~~relating to~~ the present embodiment, the carrier CR1 is fixed by the brake B3, and therefore, compared to the case wherein the clutch is located between the ring gear R1 and the sun gear S3 for example, the load on the brake B3 can be reduced, and the friction member of the brake B3 and ~~the oil pressure~~ servo can be made smaller. Therefore, these can be ~~configured on the inner circumference side in the radial direction~~ of the brake B1, and the automatic transmission can be made more compact.

Fourth Embodiment

The fourth embodiment, which is a partial modification of the first embodiment will be described with reference to Fig. 8 through Fig. 10. Fig. 8 is a schematic cross sectional diagram illustrating the automatic transmission device of an automatic transmission relating to the fourth embodiment, Fig. 9 is a operational table of an automatic transmission relating to the fourth embodiment, and Fig. 10 is a speed line diagram of an automatic transmission relating to the fourth embodiment. In Figs. 8-10, Now, components of the fourth embodiment which are the same as those of the first embodiment will be denoted with the same reference numerals, and description thereof omitted, except for partial modifications.

As Fig. 8 illustrates, the automatic transmission device 1_4 of the automatic transmission relating to the fourth embodiment changes the configuration of the planetary gear PR_2 compared to that of the automatic transmission device 1_1 of the automatic transmission of the first embodiment (see Fig. 1), and further, a brake B3 is configured, and rotation of the input shaft 2 is capable of being input to the sun gear S1 of the planetary gear PR by the clutch C3 and the carrier CR1 can be fixed by the brake B3.

The clutch C3 is configured on the planetary gear unit

PU side (left side of diagram) of the planetary gear PR ~~within this automatic transmission device 1,~~, and the brake B3 is ~~configured~~ on the planetary gear PR ~~on the~~ opposite ~~side (right side of diagram) from~~ the planetary gear unit PU. The inner ~~circumference side~~ of the ~~front edge~~ of the drum ~~shaped member~~ 25 of this clutch C3 is splined to the friction plate 73, and the ~~inner circumference side of this~~ friction plate 73 ~~is~~ splined to the hub ~~unit~~ 26. ~~Further,~~ the drum ~~shaped member~~ 25 is connected to the input shaft 2, and the hub ~~unit~~ 26 is connected to the sun gear S1.

~~The brake B3 is configured on the opposite side of the planetary gear unit PU (right side of diagram) of the planetary gear PR. This~~ Brake B3 ~~comprises an oil pressure~~ servo 16, friction plate 76, and a hub ~~unit~~ 33. The friction plate 76 ~~is~~ splined ~~on~~ the outer ~~circumference side~~ of the hub ~~unit~~ 33 ~~of this brake B3~~, ~~and~~ the hub ~~unit~~ 33 is connected to one side plate of the carrier CR1, and ~~this~~ carrier CR1 is supported by the input shaft 2 or the boss ~~unit~~ 3a ~~so as to freely rotate~~. Also, the friction plate 74 of the brake B1 ~~is~~ splined ~~on~~ the outer circumference ~~side~~ of the ring gear R1, and this ring gear R1 is connected to ~~the transmitting member 30, and~~ the sun gear S3 ~~is connected~~ via ~~this~~ transmitting member 30. In other words, the ring gear R1 and the sun gear S3 are constantly ~~in contact~~ with one another, with no clutch located between, and the

rotation ~~can~~ is constantly ~~be~~ transmitted.

~~Continuing, based on the above-mentioned construction,~~

(41) The operations of the automatic transmission ~~device~~ 1_4 will now be described ~~following~~ with reference to Fig. 8, Fig. 9, and Fig. 10 below.

~~Now,~~ Similar to the ~~above-mentioned~~ first embodiment, the vertical axes of the speed line diagram illustrated in Fig. 10 indicate the ~~revolutions~~ speed of each ~~rotation component~~ rotary element, and the horizontal axis indicates the corresponding gear ratios of these ~~rotation components~~ rotary elements. ~~Further, regarding~~ In the second planetary gear unit PU section of this speed line diagram, the vertical axis ~~to the~~ farthest ~~horizontal edge (the~~ right side of Fig. 10 corresponds to sun gear S3, and, ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axes correspond, in succession, to the carrier CR2, the ring gear R3, and the sun gear S2. ~~Further, regarding~~ In the first planetary gear unit PR section of this speed line diagram, the vertical axis to the farthest ~~horizontal edge (the~~ right side of Fig. 10 corresponds to sun gear S1, and, ~~hereafter~~ moving to the left ~~direction~~ within the diagram, the vertical axes consecutively correspond to the ring gear R1 and the carrier CR1. Further, the widths between these vertical axes are inversely proportional to the ~~inverse of the~~ number of teeth of each of the sun gears S1, S2, S3, and to the ~~inverse of the~~ number of teeth of each of the ring gears R1, R3. Also, the dotted line ~~in a~~ extending horizontally ~~direction~~ within the diagram

~~illustrate~~ represents ~~that the~~ rotation is transmitted ~~from~~ by the transmitting member 30.

As Fig. 8 illustrates, the rotation of input shaft 2 is input to the ~~above-mentioned~~ sun gear S1 by engaging the clutch C3. Further, the ~~rotation of the above-mentioned~~ carrier CR1 is fixed to the case 3 by the engagement of the brake B3, ~~retaining~~. Therefore, when the clutch C3 ~~engages~~ and the brake B3 ~~retains~~ are engaged, the above-mentioned ring gear R1 rotates at a ~~decreased~~ reduced rotation speed from that of ~~based on~~ the rotation of input shaft 2 which is input to this sun gear S1. In other words, by engaging the clutch C3 and ~~retaining with~~ the brake B3, the reduced speed rotation of the ring gear R1 is input to the sun gear S3 via the transmitting member 30.

~~By doing so,~~ As Fig. 9 and Fig. 10 illustrate, ~~regarding~~ in the planetary gear unit PR, at third speed forward, fifth speed forward, and first speed reverse, the rotation of the input shaft 2 is input to the sun gear S1 by engaging the clutch C3, and further, the carrier CR1 is fixed by ~~retaining~~ engagement of the brake B3, and therefore the reduced speed rotation is output to the ring gear R3 ~~by the fixed~~ due to fixation of the carrier CR1, and the reduced speed rotation is input to the sun gear S3 via the transmitting member 30. In this case, the ring gear R1 and the sun gear S3 are rotating at the reduced speed, and, therefore, the ~~above-mentioned~~ transmitting member 30 ~~performs~~ transmits a relatively large torque ~~transmission~~. On the other hand, ~~at~~ in first

speed forward, second speed forward, fourth speed forward, and sixth speed forward, the rotation of the sun gear S3 is input to the ring gear R1 via the transmitting member 30, but because the clutch C3 and the brake B3 are released, the carrier CR1 and the sun gear S1 rotate.

~~Now,~~ the ~~actions~~ operations of the ~~other~~ than those ~~of the~~ above-~~mentioned~~ mentioned first planetary gear unit PR are similar to those of the ~~above-described~~ first embodiment (see Fig. 2 and Fig. 3), and accordingly, description thereof will be omitted.

As described above, ~~according to~~ in the automatic transmission ~~device~~ 1_4 ~~relating to the present invention~~ of this fourth embodiment, the first planetary gear unit PR, the clutch C3, and the brake B3 are ~~configured~~ located on one axial side ~~in the axial direction~~ of the second planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured~~ located on the other axial side ~~in the axial direction~~ of the second planetary gear unit PU, ~~therefore~~ thereby providing an automatic transmission ~~can be provided that will achieve~~ having six forward speeds and one reverse speed with direct coupling ~~at~~ in fourth speed forward. For example, compared to the case wherein a clutch C1 or clutch C2 is ~~configured~~ located between the first planetary gear unit PR and the second planetary gear unit PU, the first planetary gear unit PR and the second planetary gear unit PU can be ~~configured~~ located closer together, and the transmitting member 30 ~~for~~ which transmits ~~ting~~ the reduced speed rotation can be made relatively shorter. Therefore, the automatic transmission can be made more compact

and lightweight, and further, because the inertia (inertial force ~~of inertia~~) can be reduced, the controllability of the automatic transmission can be improved, and the occurrence of speed change shock can be reduced.

Further, because the clutch C3 is ~~configured~~ located on one axial side ~~in the axial direction~~ of the second planetary gear unit PU, and the clutch C1 and the clutch C2 are ~~configured~~ located on the other axial side ~~in the axial direction~~ of the second planetary gear unit PU, ~~therefore~~ compared to the case wherein the three clutches C1, C2, and C3 are ~~configured~~ located on one side of the second planetary gear unit PU ~~for example~~, the construction of ~~an~~ the oil lines (for example, 2a, 2b, 92, 93, 94) ~~to~~ which provide oil to the ~~oil~~ hydraulic ~~pressure~~ servos 11, 12, and 13 for these clutches C1, C2, C3 ~~can be made easily, and the manufacturing process can be~~ is simplified and the costs brought down.

Further, because the oil pressure servos 11 and 13 are provided on the input shaft 2, one set of seal rings 81 and 82 provided with seal the case 3 and ~~supply oil~~ connection to the oil lines 2a, and 2b provided within input shaft 2, and therefore oil can be supplied to the oil compartments of ~~oil pressure~~ hydraulic servos 11 and 13 without providing seal rings between, for example, the input shaft 2 and the ~~oil pressure~~ hydraulic servos 11 and 13. Further, the ~~oil pressure~~ hydraulic servo 12 can supply oil from the boss ~~part~~ 3b ~~provided from the case 3~~, without passing through other units, ~~for example, in other words, can supply~~ the oil

~~oil by providing one set of seal rings 83~~. Therefore, the oil supply can be ~~supplied~~ connected simply by providing one set of seal rings 81 and 82, 83 ~~each~~ respectively for the ~~oil pressure~~ hydraulic servos 11, 12, and 13, ~~and~~ sliding resistance from the seal rings can be minimized, and therefore the efficiency of the automatic transmission can be improved.

Further, because the clutch C1 ~~is a clutch that~~ engages at relatively slow to medium speeds ~~levels~~, i.e. ~~of~~ first speed forward, second speed forward, third speed forward, and fourth speed forward, and ~~therefore than this clutch C1~~ is released in ~~at~~ fifth speed forward, sixth speed forward, and ~~or~~ first speed reverse, which are relatively high speeds ~~levels~~, the hub unit 22 that connects ~~in particular this~~ clutch C1 and sun gear S2 rotates at a relatively high speed ~~rotation~~ or in reverse ~~rotation~~ (see Fig. 3), and because ~~on the other hand~~ the transmitting member 30 rotates at reduced speed rotation in ~~at~~ fifth speed forward and ~~or~~ first speed reverse, ~~and~~ there may be cases wherein the transmitting member is fixed at sixth speed forward, and the ~~rotation~~ difference in rotational speed between the hub unit 22 and the transmitting member 30 may become large. However, because this clutch C1 is located on the ~~opposite~~ side of the first planetary gear unit PR ~~via~~, the second planetary gear unit PU, opposite the hub unit 22 and the transmitting member 30 can be ~~configured~~ spaced apart, and compared with the case wherein for example those units are ~~configured~~ in contact with a multi-axial

construction, ~~the~~ decreased efficiency of the automatic transmission resulting from ~~the~~ relative rotation ~~occurring~~ because of friction between those units can be ~~prevented~~.

Further, because the counter gear 5 is ~~configured in the~~ axial ~~direction between~~ the planetary gear unit PU and the planetary gear PR, the counter gear 5 can be ~~configured in~~ approximately the center ~~in the axial direction~~ of the automatic transmission. For example, when the automatic transmission is mounted on ~~the~~ vehicle, enlarging ~~towards~~ one direction ~~of the axis~~ (particularly ~~in~~ the rear ~~direction~~ when the input ~~side~~ from the drive source is the front ~~direction~~) ~~can be prevented~~ because the counter gear 5 is mounted ~~to match~~ the drive wheel transmission mechanism. Because of this, particularly in the case of an FF vehicle, ~~the~~ interference ~~toward~~ the front wheels is reduced, ~~and the~~ mountability on a vehicle ~~can be~~ improved, ~~such~~ the steering angle ~~being greatly~~ improved ~~(for example)~~.

~~Further, in the event that~~ the ~~oil pressure~~ servo 13 is ~~configured~~ adjoined ~~to~~ the planetary gear PR ~~for example~~, and the hub unit 26 is made to ~~be~~ the cylinder ~~unit for~~ the ~~oil pressure~~ servo 13, ~~the necessity arises~~ to provide one set of seal rings between the hub ~~unit~~ 26 and the input shaft 2. However, the ~~oil pressure~~ servo 13 of the clutch C3 is ~~configured~~ on the ~~opposite~~ side of the friction plates 73 ~~from~~ the planetary gear PR ~~in the axial direction~~,

~~therefore~~ seal rings are not ~~provided, in other words,~~ needed so that the number of seal rings can be reduced, sliding resistance can be reduced, and by doing so, the efficiency of the automatic transmission can be improved.

Further, because the automatic transmission ~~device~~ 1_4 ~~according to~~ of the ~~present~~ fourth embodiment is ~~a tranemission device that is~~ directly coupled ~~at~~ in fourth speed forward. ~~Therefore~~, ~~at~~ in fifth speed forward, and in sixth speed forward, the gear ratio can be ~~specified at~~ a high ratio, and particularly ~~when mounted on a vehicle in the event that the vehicle is running~~ at ~~a~~ high vehicle speed, the engine ~~revolutions~~ can be ~~lowered, and this contributes to~~ reduced and the ~~quietness of the~~ becomes more quiet vehicle ~~while~~ running at a high speed.

~~In order to solve the above-described problems, proposals have been made such as those in~~ Japanese Unexamined Patent Application Publication No. 8-68456 proposes ~~However, the product in this Publication has~~ a construction wherein a clutch is ~~configured~~ located on the line that transmits the reduced speed rotation of the reducing planetary gear unit to the input rotary element ~~rotation component~~ of the planetary gear unit, and because ~~the line that transmits~~ this reduced speed rotation is transmitted ~~a line wherein~~ with a ~~large~~ high torque ~~is input~~, the clutch or members that transmit the torque must be constructed so as to withstand this ~~large~~ high torque. In other words, the number of friction members on the clutch must be increased, and the size thereof

increased, or the ~~oil pressure~~ hydraulic servo ~~for pressurizing~~ which operates the ~~friction member~~ clutch must be made larger. Further, because a brake must be ~~configured~~ provided to ~~retain~~ stop the ~~rotation component~~ rotary element of the planetary gear unit front, this automatic transmission was ~~insufficient with regard to being compact in size.~~

~~Therefore~~, By constructing a compact clutch and brake in the area of the reducing planetary gear unit, ~~it is an object of~~ the present embodiment ~~to~~ provides an automatic transmission which is ~~that solves the above-mentioned problems~~ more compact overall.

~~Therefore, according to~~ In the automatic transmission ~~device~~ of this fourth 1, ~~relating to the present~~ embodiment, the clutch C3 is located between the input shaft 2 and the sun gear S1, and therefore, compared ~~to the case~~ with an embodiment wherein the clutch C3 is located ~~for example~~ between the ring gear R1 and the sun gear S3, the ~~burden~~ load on the clutch C3 can be decreased, and the clutch C3 can be made more compact. Further, because the friction members and ~~oil pressure~~ hydraulic servo of the clutch C3 can be made smaller, they can be ~~configured on the inner circumference side in the radial direction~~ located radially inward of the brake B1, and the automatic transmission can be made more compact.

~~Now, the above~~ While the first through fourth embodiments ~~relating to~~ of the present invention have been described above as ~~being applicable to an~~ automatic transmissions having a torque converter, ~~but should~~ the invention is not ~~be~~ so limited ~~to this~~, and any motion starting device may be used that ~~would~~ transmits the

torque (rotation) at the start of movement. Further, ~~a case wherein this is~~ while the above-described embodiments have the transmission of the invention mounted on a vehicle with an engine as a drive source ~~has been described~~, ~~but should~~ the invention is not ~~be~~ so limited ~~to this,~~ and any drive source may be used as a matter of course. For example, ~~and this~~ the transmission may be mounted on a hybrid vehicle. Further, while the above-~~mentioned~~ described automatic transmission is favorably ~~for~~ used in a FF vehicle, ~~but should~~ it is not ~~be~~ limited to this, and can be used in a FR vehicle, a four-wheel drive vehicle, or vehicles with other types of drive systems.

Further, the reducing (first) planetary gear unit according to the above first through fourth embodiments has been described as one that reduces rotation speed of the ring gear by fixing the carrier while inputting the rotation of the input shaft into the sun gear, but ~~should~~ the invention is not ~~be~~ so limited ~~to this~~, and may reduce rotation speed of the ring gear by fixing the sun gear while inputting the rotation of the input shaft into the carrier.

~~Industrial Applicability~~

As described above, the automatic transmission according to the present invention ~~is beneficial~~ can be advantageously mounted on vehicles such as automobiles, trucks, busses, and so forth, and is particularly suitable for use with vehicles which require a reduction in size and reduction in weight of the transmission ~~from~~ for mounting on ~~mountability to~~ the vehicle, and further require reduction

of speed change
~~in~~ shock, ~~of changing speeds.~~

ABSTRACT

A first planetary gear unit PR and a clutch C3 for outputting reduced speed rotation are located on one axial side of a second planetary gear unit PU ~~in the axial direction (right side of the diagram)~~, and a clutch C1 for connecting and disconnecting ~~the rotation of~~ an input shaft 2 ~~input~~ from a sun gear S2 and a clutch C2 for connecting and disconnecting ~~the rotation of~~ the input shaft 2 input from a carrier CR2 are located on the other axial side ~~(left side of the diagram)~~ of the second planetary gear unit PU ~~in the axial direction, and~~ An output ~~member~~ mechanism is ~~configured~~ between said first and second planetary gear units ~~and reducing planetary gear and engaging means. By doing so,~~ As compared with a drive ~~train to the case~~ wherein the clutch C1 or clutch C2 is located between the two planetary gear units ~~PR and the planetary gear unit PU~~, the two planetary gear ~~PR and the planetary gear~~ units ~~PU~~ can be ~~configured close~~ located closer together, and a transmitting member ~~30~~ that transmits the reduced speed rotation ~~becomes~~ can be made shorter. Further, compared to a drive train ~~the case~~ wherein ~~, for example,~~ the clutches C1, C2, C3 are located ~~configured~~ together on one axial side ~~of the axial direction~~, the ~~construction of an~~ oil supply to hydraulic servos can be ~~line is~~ simplified.